

"Traditional" Areas of Chemistry

- **Physical**

 - Equilibrium
 - Structure
 - Dynamics

- **Inorganic**

 - Periodicity
 - Reactions

- **Organic**

 - Carbon chemistry
 - Synthesis

- **Analytical**

 - Spectroscopy
 - Separations
 - Detection Devices

"Interdisciplinary" Areas of Chemistry

- **Biochemistry**

 - Bio-organic
 - Bio-physical

- **Materials Chemistry**

 - Ceramics
 - Superconductors
 - Composites
 - Polymers

- **Environmental Chemistry**

 - Atmospheric
 - Water
 - Pollutant Remediation

- **Geochemistry**

"Conceptual" Areas of Chemistry

● Fundamental Principles

Quantum Mechanics

Quantized Energy
Wave-Particle Duality
Uncertainty Principle

Thermodynamics

Energy
Entropy

(Relativity)

Mass-Energy Equivalence
Gravitation

● Applications

Chemical Bonding

Reaction Chemistry

Synthesis
Analysis

Dynamics

Structure

"Road Map" (Microscopic → Macroscopic)

● Quantum Mechanics and Atomic Structure

Waves, Light, and Energy Quantization
Atomic Spectroscopy and the Bohr Atom
Wave Mechanics

Wave-Particle Duality
Uncertainty Principle
Schrödinger Equation

Atomic Orbitals

Hydrogen-Like Atoms
Many-Electron Atoms
Periodicity
Energetics

● Chemical Bonding

Properties of Chemical Bonds

Types
Polarity

Molecular Geometry

Molecular Orbital Theory

Diatomic Molecules
Polyatomic Molecules

Localized Electron Density Approximation

Valence-Bond Theory
Resonance
Molecular Spectroscopy

● The Gaseous State

Ideal Gas Law

Pressure and Temperature Effects

Gas Mixtures

Kinetic-Molecular Theory of Gases

Real Gases

● Chemical Equilibrium

Law of Mass Action

Reaction Quotient

Equilibrium Constant

Le Chatelier's Principle

● Thermodynamics

Thermodynamic State Functions

Energy, Work, and Heat

First Law of Thermodynamics

Heat Capacities

Thermochemistry

Reversible Gas Processes

Isothermal

Adiabatic

Carnot Cycle

Second Law of Thermodynamics

Entropy

Spontaneous Processes

Gibbs Free Energy and Chemical Equilibrium

● **Chemical Kinetics**

Rate Laws

Reaction Mechanisms

Elementary Reactions

Reaction Intermediates

Steady-State Approximation

Temperature Effects

Arrhenius Theory

Activation Energy

Reaction Dynamics and Absolute Rate Theory